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(54) A process for the production of insulating panels

(57) Agricultural bast-waste with silicic acid content, mainly rice-hull, is used as basic material. It is first fiberized, and may be dewaxed. Filling material, e.g. perlite or rice-straw or asbestos, and binding material as for instance two-component synthetic resin-based adhesive are added to the fiberized rice-hull, and these are mixed to homogeneous mixture. The so-obtained mixture is cold or hot moulded.

SPECIFICATION

Process for the production of insulating panels

The invention relates to a process for the production of insulating panels used to advantage mainly in the construction industry as insulating wall or roof panels.

Heat and sound insulating panels are widely used, generally made of synthetic foam of mineral oil origin, or from rock-wool, e.g. from basalt wool. Their common characteristic is that their production and installation are costly and labour-intensive, furthermore they are not sufficiently durable.

Escalating oil prices make the use of new, less expensive basic materials necessary for the insulating panels as well.

The invention is aimed at elimination of above deficiencies.

Accordingly the task to be solved with the invention is to develop an insulating panel production process whereby durable insulating panels can be produced at a relatively low cost, and having at least the same physical properties as the known insulating panels.

The invention is based on the recognition that several million tons of rice-hull are derived each year, which for its high silicic acid content is not suitable for feeding, nor as litter in the agriculture, thus it is regarded as environment pollutant. In view of the fact, that the rice-hull is difficult to burn /flash point is around 800°C/, thus its annihilation by burning is very costly. Further characteristic of the rice-hull is that it does not decay and rodents and insects do not like it either.

The objective according to the invention was solved with an insulating panel production proces wherein agricultural bast-waste with silicic acid content, mainly rice-hull, is used as basic material. First it is fiberized and dewaxed, then filling material, preferably perlite or rice-straw, or asbestos, followed with binding material, preferably two-component synthetic resin-based adhesive are added to the fiberized and dewaxed rice-hull and mixed to homogenous mixture, then the so-obtained mixture is moulded to an insulating panel by pressing in a template or mould.

It is advisable to carry out the dewaxing by steeping with lime hydrate or lime chloride.

Another process according to the invention is when the pressing is carried out at a pressure of 12–25 bar and between 80 and 120°C temperature. With this hot pressing, the hardening time of the adhesive, and consequently the cycle time of production, can be reduced.

If necessary, the hardening of the adhesive can be accelerated by blowing hot air of 50–60°C onto the insulating panels following the moulding.

In order to improve the product, prior to dewaxing, the powdery substance derived at fiberization—which is harmful to the health—is removed.

The invention is described in detail by way of three examples of the process according to the invention.

Example 1.

Insulating panel of 5 × 60 × 300 cm size is made by cold pressing. For this purpose first the rice-hull is fiberized in a conventional roll mill, partly to increase the specific surface of the rice-hull, and partly to stop the flexibility of the rice-hull pieces. Thus at fiberization the rice-hull is actually torn to its elementary fibres. The weight percent distribution of the granular structure obtained after fiberization is the following:

– 3.5–5 mm = 20 weight %
– 1.8–3.5 mm = 16 weight %
– 1–1.8. mm = 64 weight %

The about 10% powdery substance derived after fiberization is separated.

Next the fiberized rice-hull is steeped with lime chloride solution, whereby the wax is removed from its surface. This steeping with lime chloride may be carried out for instance in the worm conveyor itself.

Filling material is added to the fiberized and dewaxed rice-hull, such as perlite in the present case, and adhesive known by the tradename "ARBOCOL-NORMAL" as binding material and these are mixed to homogenous mixture for instance in rotary forced mixing machine. Ammonium chloride is used as setting-starter of the adhesive. The so-obtained mixture is poured into template and pressing under 1.5 bar pressure it is moulded in insulating panel. Following the hardening of the adhesive, about 10–20—minutes, the template is stripped from the product.

Proportion of the weight fractions of components is the following:

120	weight	fraction	fiberized rice-hull
40	,,	,,	"P2" type perlite
90	,,	,,	"ARBOCOL-NORMAL adhesive
2	,,	,,	ammonium chloride setting-starter
100	,,	,,	water
5	,,	,,	lime chloride

Example 2.

8 cm thick roof insulating panel was produced. The process differs from the one described in example 1 only in that cut and carded rice -straw is used instead of perlite as additive, furthermore thermosetting "ARBOCOL-FKC" adhesive, hardening at 120°C is used as binding material. Press heated to 120°C is used for pressing and the applied pressure is 20–25 bar.

Proportion of weight fractions of the components is the following:

120	weight	fraction	fiberized rice-hull
80	,,	,,	cut and carded rice-straw
158	,,	,,	"ARBOCOL-FKC" adhesive
6.25	,,	,,	ammonium chloride setting starter
156	,,	,,	water
8	,,	,,	lime chloride

Example 3.

10 cm thick insulating panel was produced for premises exposed to high thermal load. Its production process is essentially the same as that of example 1. The difference is only that in addition to perlite, asbestos powder or asbestos of short fibre is added to the mixture. Furthermore water glass and sodium silico-fluoride was used as binding material.

Proportion of weigh fractions of the components is the following:

40 weight fraction fiberized rice-hull
20 weight fraction "P2" type perlite
95 weight fraction asbestos powder of asbestos of short fibre
35 weight fraction water glass
4 weight fraction sodium silico-fluoride
10 weight fraction water
4 weight fraction lime hydrate

The insulating panels produced with the process according to the invention are of very light weight, volume 210–310 kilopond/m^3. The experiment results demonstrate that they have very good heat insulation property, thermal conductivity 0.045–0.065 kcal/mh °C. Compressive strength of the insulating panels according to the invention was 7–60 kp/cm^2, moisture absorption in 100% relative humidity after 96 hours was only 5.3% of the weight.

The other experiments conducted with the insulating panel according to the invention, confirmed its durability, it is difficult to burn, painting and tapestry are readily applicable, can be glued, swan with metal-tipped tool, drilled, veneered and surface treated with thermal press, furthermore it can be provided with optimal waterproof layer, such as foil.

The insulating panel according to the invention may be used as heat- and sound-insulating wall panel, roof insulating panel, sandwich panels, as false ceiling and ornamental panel, moreover as other covering profile. By adding suitable additives, certain physical properties of the insulating panels, such as fire resistance, can be further improved with the addition of asbestos.

In comparison with the known rock-wool based insulating panel production process, the heating oil requirement of the process according to the invention is 25%, and the electric power requirement is about 6–8%.

CLAIMS

1. Process for the production of insulating panel, characterized in that agricultural bast-waste with silicic acid content, mainly rice-hull, is used as basic material, that is first fiberized, followed by adding first filling material, preferably perlite, or rice-straw, or asbestos to the fiberized and dewaxed rice-hull, and binding material, preferably a two-component synthentic resin-based adhesive and these are mixed to homogeneous mixture, then the so-obtained mixture is moulded by pressing.

2. Process as claimed in claim 1, characterized in that the dewaxing is carried out by steeping with lime hydrate or lime chloride.

3. Process as claimed in claim 1 or 2, characterized in that the pressing is carried out at a pressure of 12–24 bar and between 80 and 120°C temperature.

4. Process as claimed in any of claims 1–3, characterized in that hardening of the adhesive

for the insulating panel is accelerated by blowing 50–60°C hot air after the moulding.

5. Process as claimed in any of claims 1–4, characterized in that prior to dewaxing the powdery substance derived from fiberization of the rice hull is separated.

6. A process for the production of insulating panels substantially as herein described with reference to any one of the examples.

7. Insulating panels wherever produced by a process as claimed in any preceding claim.

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YASUTAKU T *JO 4045-156-A

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Moisture-proof powdered rice hull used as plastics filler - obtd. by mixing powdered rice hull with hydrophobic silica and chemical drier e.g. magnesium oxide

C92-050248

A(8-R7)

Hull is obtd. by grinding rice hull to predetermined particle size under heating and pressurising, and mixing the powdered mass with hydrophobic silica (1) and a chemical drier (2) in amts. corresponding to the moisture content (3) of the powdered mass.

(1) coats the surface of dried rice hull powder and keeps the rice hull powder in absolute dry state. (2) is MgO. (3) is 1-2 wt%.

USE/ADVANTAGE - Used as bulk filler and modifier of plastics and rubber. As the powdered rice hull is anhydrous, the plastics or rubber added to the powdered rice hull is stable to heat and improves heat resistance. When using hydrophobic silica in amts. of 1/1000-5/1000 of the amts. of powdered rice hull, silica covers the whole surface of powdered rice hull. (4pp Dwg.No.0/0)

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DENKI KAGAKU KOGYO KK (SUMI-) *JO 1249-617-A
30.03.88-JP-074703 (04.10.89) C01b-33/02
Raw material for silicon - made of ash of carbonised rice hulls
C89-148790

E(31-P6A) L(2-G, 2-G12)

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Material (1) that is formed by the carbonisation of rice hulls, characterised by contg. 60-80 wt.% of silica and 20-40 wt.% of carbon. (1) is mfd. by heating the rice hulls in the inert atmosphere contg. 2-5 vol.% of oxygen at the temp. 600-800 deg.C and making the rice hulls to carbonise.

USE/ADVANTAGE - Available for manufacturing raw material for silicon and/or silicon compunds from the rice hulls. (4pp Dwg.No. 0/0)